

## SMOKY HILL/SALINE RIVER BASIN TOTAL MAXIMUM DAILY LOAD

### Water Body: Herington City Lake Water Quality Impairment: Eutrophication

**Subbasin:** Lower Smoky Hill

**Counties:** Dickinson and Marion

**HUC 8:** 10260008                      **HUC 11 (14): 070 (020)**

**Ecoregion:** Flint Hills (28)

**Drainage Area:** Approximately 17.2 square miles

**Conservation Pool:** Area = 186.5 acres  
Watershed Area: Lake Surface Area = 59:1  
Maximum Depth = 7.0 meters (23 feet)  
Mean Depth = 2.7 meters (8.9 feet)  
Retention Time = 0.83 year (10 months)

**Designated Uses:** Primary and Secondary Contact Recreation; Expected Aquatic Life Support; Drinking Water; Food Procurement; Industrial Water Supply

**Authority:** City of Herington

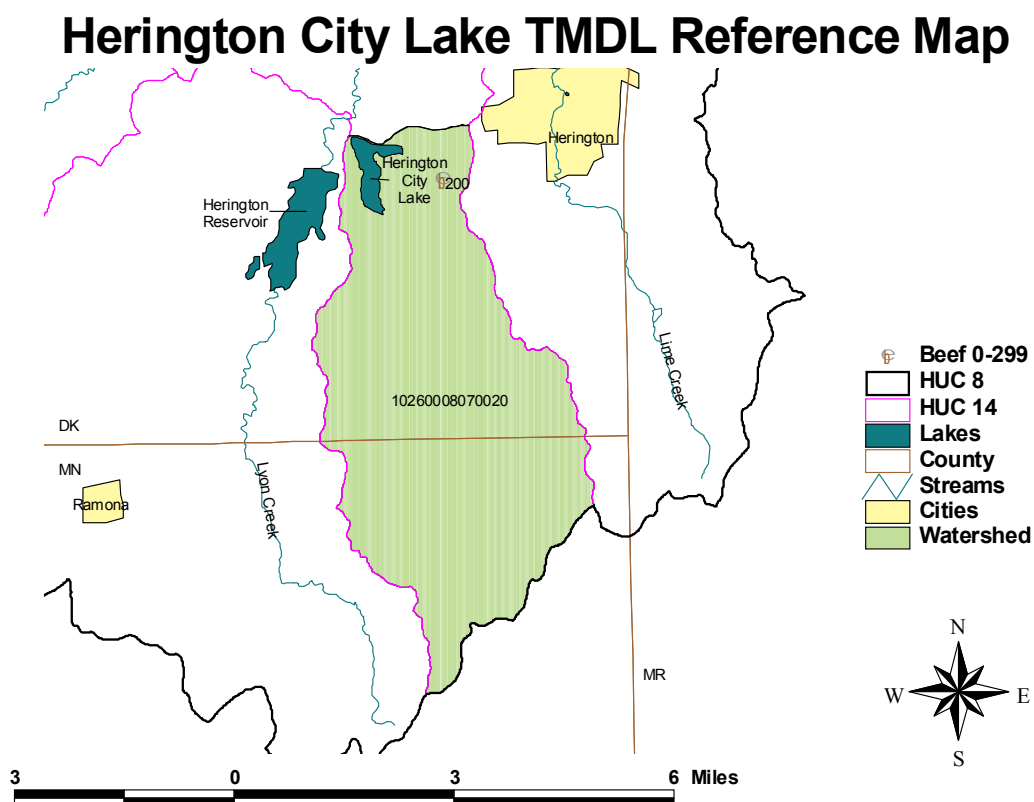
**2002 303(d) Listing:** Smoky Hill/Saline River Basin Lakes

**Impaired Use:** All uses are impaired to a degree by eutrophication

**Water Quality Standard:** Nutrients - Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).

The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation. (KAR 28-16-28e(c)(7)(A)).

Figure 1



## 2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

**Level of Eutrophication:** Fully Eutrophic, Trophic State Index = 57.77

**Monitoring Sites:** Station 069701 in Herington City Lake (Figure 1).

**Period of Record Used:** One survey during 1989

**Current Condition:** In 1989, Herington City Lake had chlorophyll a concentration  $16.0 \mu\text{g/L}$  (Appendix A). The Secchi Disc Depth was 1.75 meters. Nitrogen and phosphorus concentrations were not measured.

The Trophic State Index is derived from the chlorophyll a concentration. Trophic state assessments of potential algal productivity were made based on chlorophyll a concentrations, nutrient levels and values of the Carlson Trophic State Index (TSI). Generally, some degree of eutrophic conditions is seen with chlorophyll a concentrations over  $7 \mu\text{g/l}$  and hypereutrophy

occurs at levels over 30  $\mu\text{g/l}$ . The Carlson TSI, derives from the chlorophyll concentrations and scales the trophic state as follows:

1. Oligotrophic TSI < 40
2. Mesotrophic TSI: 40 - 49.99
3. Slightly Eutrophic TSI: 50 - 54.99
4. Fully Eutrophic TSI: 55 - 59.99
5. Very Eutrophic TSI: 60 - 63.99
6. Hypereutrophic TSI:  $\geq 64$

### **Interim Endpoints of Water Quality (Implied Load Capacity) at Herington City Lake over 2008 - 2012:**

In order to improve the trophic condition of the lake from its current fully Eutrophic status, the desired endpoint will be to maintain summer chlorophyll a concentrations below 12  $\mu\text{g/L}$ .

#### **Current Condition and Reductions for Herington City Lake**

| <b>Parameter</b>                                   | <b>Current Condition</b> | <b>TMDL</b> | <b>Percent Reduction</b> |
|--|--------------------------|-------------|--------------------------|
| Total Phosphorus Load (lb/year)                    | 7,028                    | 4,481       | 36 %                     |
| Total Phosphorus Concentration ( $\mu\text{g/L}$ ) | 57.2                     | 42.7        | 25 %                     |
| Chlorophyll a ( $\mu\text{g/L}$ )                  | 16                       | < 12        | 25 %                     |

### **3. SOURCE INVENTORY AND ASSESSMENT**

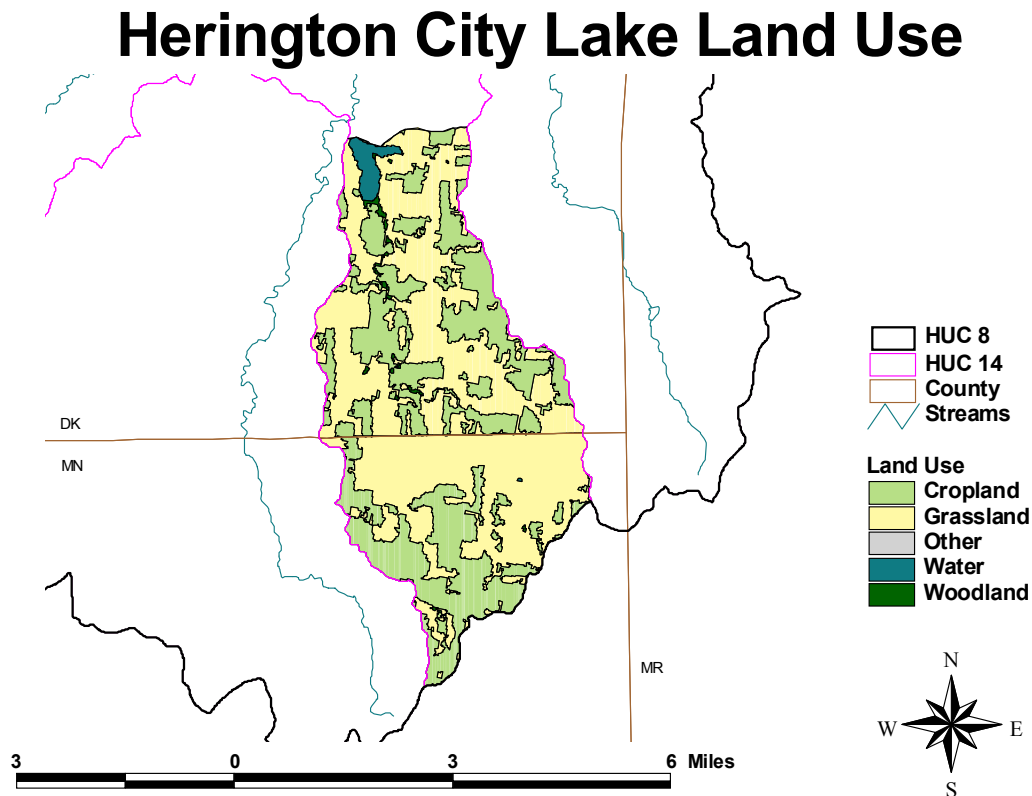
**Land Use:** The watershed around Herington City Lake has a moderate potential for nonpoint source pollutants. An annual phosphorus load of 7,028 pounds per year is necessary to correspond to the concentrations seen in the lake.

One source of phosphorus within Herington City Lake is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 39.2% of the watershed is cropland (Figure 2).

Phosphorus from animal waste is a potential contributing factor. Animal waste, from livestock waste management systems, may add to the phosphorus load going into the lake. However, given the controls for the systems, animal waste coming from grazing areas is a more likely contributor. Fifty-nine percent of land around the lake is grassland. There is one beef animal feeding operation in the watershed. All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating from their areas. Such systems are designed for the 25 year, 24 hour rainfall/runoff event, which would be indicative of flow durations well under 10 percent of the time. In Dickinson County, such an event would generate 5.8 inches of rain, yielding 4.7 to 5.4 inches of runoff in a day. NPDES permits, also non-discharging, are issued for facilities with more than 1,000 animal

units. The facilities in this watershed are not of this size. Potential animal units for these facilities in the watershed total 200. The actual number of animal units on site is variable, but typically less than potential numbers.

**Figure 2**



Two cities are located outside of the Ellis City Lake watershed. The City of Ramona is expecting a 6.4% population decline to the year 2020. The City of Herington anticipates an 11.8% increase in population. The population density within the watershed is 10.0 people per square mile. Twenty-nine percent of the homes in Dickinson County have septic systems. Septic systems around the lake contribute to the nutrient load.

**Contributing Runoff:** The watershed's average soil permeability is 0.5 inches/hour according to NRCS STATSGO database. About 100% of the watershed produces runoff even under relatively low (1.5"/hr) potential runoff conditions. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the watersheds' soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.5"/hr of rain will generate runoff from 14.2% of this watershed, chiefly along the stream channels.

**Background Levels:** The atmospheric phosphorus and geological formations (i.e., soil and bedrock) may contribute to phosphorus loads. Nutrients from wildlife waste are another contributing factor.

#### **4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY**

While light is the limiting factor in Herington City Lake, Total Phosphorus is allocated under this TMDL, because a phosphorus reduction will have a large effect on the managing the algal community. The Load Capacity is 4,481 pounds per year of phosphorus and was calculated using the CNET model. More detailed assessment of sources and confirmation of the trophic state of the lake must be completed before detailed allocations can be made. The general inventory of sources within the drainage does provide some guidance as to areas of load reduction.

**Point Sources:** A current Wasteload Allocation of zero is established by this TMDL because of the lack of point sources in the watershed. Should future point sources be proposed in the watershed and discharge into the impaired segments, the current wasteload allocation will be revised by adjusting current load allocations to account for the presence and impact of these new point source dischargers. As previously noted in the inventory and assessment section, sources such as non-discharging permitted livestock waste management systems located within the watershed do not discharge with sufficient frequency or duration to add to an impairment in the lake.

**Nonpoint Sources:** Water quality violations are partially due to nonpoint source pollutants. Background levels may be attributed to atmospheric deposition and geological sources. The assessment suggests that cropland and animal waste contribute to the elevated total phosphorus concentrations in the lake. Generally a Load Allocation of 4,033 pounds of total phosphorus per year, leading to a 36% reduction, is necessary to reach the endpoint.

**Defined Margin of Safety:** The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus load and the chlorophyll a endpoint. Therefore, the margin of safety will be 448 pounds per year of total phosphorus taken from the load capacity subtracted to compensate for the lack of knowledge about the relationship between the allocated loadings and the resulting water quality.

**State Water Plan Implementation Priority:** Because of the lack of recent monitoring data, this TMDL will be a Low Priority for implementation.

**Unified Watershed Assessment Priority Ranking:** Herington City Lake lies within the Lower Smoky Hill (HUC 8: 10260008) with a priority ranking of 35 (Medium Priority for restoration).

**Priority HUC 11s:** Since it encompasses the entire Herington City Lake watershed, the HUC 11 (10260008070) should take priority.

## **5. IMPLEMENTATION**

### **Desired Implementation Activities**

There is a very good potential that agricultural best management practices will allow full use support to take place in Herington City Lake. Some of the recommended agricultural practices are as follows:

1. Implement soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain conservation tillage and contour farming to minimize cropland erosion.
3. Install grass buffer strips along streams.
4. Reduce activities within riparian areas.
5. Implement nutrient management plans to manage manure application to land.

### **Implementation Programs Guidance**

#### **Nonpoint Source Pollution Technical Assistance - KDHE**

- a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management
- b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
- c. Provide technical assistance on nutrient management in vicinity of streams.
- d. Update and implement nutrient and sediment abatement strategies.
- e. Develop a Watershed Restoration and Protection Strategy for HUC 10260008.

#### **Water Resource Cost Share Nonpoint Source Pollution Control Program - SCC**

- a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.
- b. Provide sediment control practices to minimize erosion and sediment and nutrient transport.

#### **Riparian Protection Program - SCC**

- a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
- b. Develop riparian restoration projects.
- c. Promote wetland construction to assimilate nutrient loadings.

#### **Buffer Initiative Program - SCC**

- a. Install grass buffer strips near streams.
- b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

#### **Extension Outreach and Technical Assistance - Kansas State University**

- a. Continue to educate residents and landowners about nonpoint source pollution.
- b. Educate agricultural producers on sediment, nutrient, and pasture management.

- c. Educate livestock producers on livestock waste management and manure applications and nutrient management planning.
- d. Provide technical assistance on livestock waste management systems and nutrient management plans.
- e. Provide technical assistance on buffer strip design and minimizing cropland runoff.
- f. Encourage annual soil testing to determine capacity of field to hold phosphorus.

**Time Frame for Implementation:** Continued monitoring over the years from 2003 to 2008. After 2008, the monitoring results will be evaluated, and the allocations will be adjusted if needed.

**Targeted Participants:** Primary participants for implementation will be agricultural producers who are within the drainage of the lake. A detailed assessment of sources will be conducted by KDHE over 2003-2008.

**Milestone for 2008:** The year 2008 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Herington City Lake will be reexamined to confirm the impaired status of the lake. Should the case of impairment remain, source assessment, allocation, and implementation activities will ensue.

**Delivery Agents:** The primary delivery agents for program participation will be the City of Herington. Producer outreach and awareness will be delivered by Kansas State Extension.

**Reasonable Assurances:**

**Authorities:** The following authorities may be used to direct activities in the watershed to reduce pollutants.

1. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.
2. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.
3. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.
4. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.

6. The *Kansas Water Plan* and the Smoky Hill/Saline Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

**Funding:** The State Water Plan Fund annually generates \$16-18 million and is the primary funding mechanism for implementing water quality protection and pollutant reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are a Low Priority consideration.

**Effectiveness:** Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming and installation of buffer strips within the watersheds cited in this TMDL.

## 6. MONITORING

Additional data, to further determine source loading and mean summer lake trophic condition, would be of value prior to 2008. Further sampling and evaluation should occur twice before 2008.

## 7. FEEDBACK

**Public Meetings:** Public meetings to discuss TMDLs in the Smoky Hill/Saline Basin were held January 7 and March 5, 2003 in Hays. An active Internet Web site was established at <http://www.kdhe.state.ks.us/tmdl/> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Smoky Hill/Saline Basin.

**Public Hearing:** A Public Hearing on the TMDLs of the Smoky Hill/Saline Basin was held in Hays on June 2, 2003.

**Basin Advisory Committee:** The Smoky Hill/Saline Basin Advisory Committee met to discuss the TMDLs in the basin on October 3, 2002, January 7, March 5, and June 2, 2003.

**Milestone Evaluation:** In 2008, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of Herington City Lake. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.



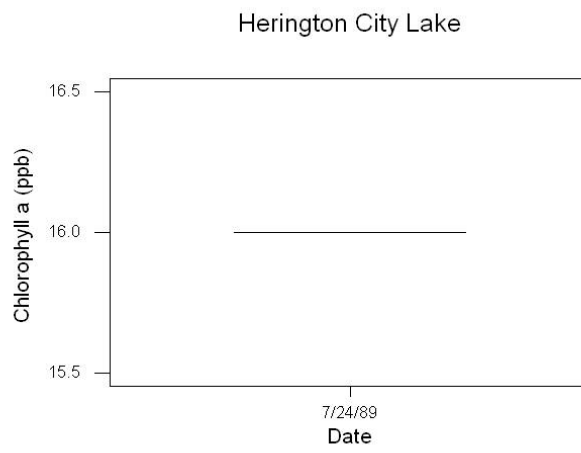
**Consideration for 303(d) Delisting:** The lake will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2008-2012. Therefore, the decision for delisting will come about in the preparation of the 2012 303(d) list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

**Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process:** Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2004 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2004-2008.

### **Bibliography**

Lisceck, Bonnie C. Methodology Used in Kansas Lake TMDLs [web page] Jul. 2001;  
<http://www.kdhe.state.ks.us/tmdl/eutro.htm> [Accessed 30 September 2002].

## Appendix A - Boxplots



## Appendix B - Input for CNET Model

| Parameter                        | Value Input into CNET Model |
|----------------------------------|-----------------------------|
| Drainage Area (km <sup>2</sup> ) | 44.6                        |
| Precipitation (m/yr)             | 0.77                        |
| Evaporation (m/yr)               | 1.4                         |
| Unit Runoff (m/yr)               | 0.14                        |
| Surface Area (km <sup>2</sup> )  | 0.75                        |
| Mean Depth (m)                   | 2.7                         |
| Depth of Mixed Layer (m)         | 2.7                         |
| Depth of Hypolimnion (m)         | 0.8                         |
| Observed Phosphorus (ppb)        | N/A                         |
| Observed Chlorophyll-a (ppb)     | 16.0                        |
| Observed Secchi Disc Depth (m)   | 1.8                         |

## Output from CNET Model

| Parameter                   | Output from CNET Model |
|-----------------------------|------------------------|
| Load Capacity (LC)*         | 4481 lb/yr             |
| Waste Load Allocation (WLA) | 0 lb/yr                |
| Load Allocation (LA)        | 4033 lb/yr             |
| Margin of Safety (MOS)      | 448 lb/yr              |

\*LC = WLA + LA + MOS

Approved Sep. 30, 2003